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Self-defining memories predict engagement in structured activity in First Episode Psychosis, independent of neurocognition and metacognition.

Running title: Self-defining memories in First Episode Psychosis.

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ABSTRACT

Background: Self-defining memories (SDM) are vivid personal memories, related to narrative identity. Individuals with schizophrenia report less specific, more negative, and extract less meaning from these memories compared to control groups. Self-defining memories have been shown to be predicted by neurocognition, associated with metacognition, and linked to goal outcomes in healthy controls. As neurocognition and metacognition are known predictors of poor functioning in psychosis, self-defining memories may also be a predictor. No study has assessed the relationship to functioning or pattern of SDMs in First Episode Psychosis.

Methods: This was a cross-sectional study involving 71 individuals with First Episode Psychosis (FEP) and 57 healthy controls who completed a self-defining memories questionnaire. FEP participants completed measures of neurocognition, metacognition (Metacognitive Assessment Interview), functional capacity (The UCSD Performance-Based Skills Assessment) and functional outcome (Time-Use Survey).

Results: Self-defining memories reported by individuals with FEP were less integrated compared to healthy controls. Within the FEP sample, holding less specific memories was associated with engagement in significantly fewer hours of structured activity per week and specificity of SDMs mediated the relationship between neurocognition and functional outcome, independent of metacognition.

Conclusion: This is the first study to assess SDMs in FEP and to explore the important role of SDMs on clinical outcomes, compared to healthy controls. This study suggests that elaborating on specific self-defining memories is a valid therapeutic target and may be considered a tool to improve daily functioning in FEP.

Key words: First Episode Psychosis, memories, functioning, metacognition.

INTRODUCTION

Self-defining memories (SDMs) are vivid, intense and well-rehearsed personal memories¹, related to narrative identity and ‘ingredients’ for the life story². Prior research has considered four dimensions of interest for SDM³: i) specificity- the ability to provide a detailed, clear memory, ii) integration- capacity to learn from, and incorporate, the memory into self-knowledge, iii) type of event- linked to a general theme (e.g. achievements) or unresolved conflict (e.g. mental health crises)¹, and iv) content valence- the strength of affective response when recalling the SDM.

Self-defining, or autobiographical, memories reported by individuals with schizophrenia have been found to be less specific⁴⁻⁶, more negative⁷, and individuals extract less meaning from these types of memories compared to control groups⁷, despite cues⁸.

In terms of the separate dimensions of SDMs, research on autobiographical memories (ATM) highlights that specific ATM can be impacted by neurocognitive deficits in psychosis^{9,10}. They may also be linked to negative symptoms in schizophrenia¹¹, which are related to avoidance of trauma memories, hence a lower likelihood of reporting specific memories. Specific memories are suggested to be associated with impairment in executive control and functional avoidance¹², and influence goal outcomes in control participants^{1,3} as individuals who report specific memories are better able to use appropriate cognitive-affective information to achieve their goals¹. Conway and Pleydell-Pearce’s Self-Memory System¹³ (SMS) suggested that ATM contain knowledge at three hierarchical levels of specificity: lifetime period, general events and event-specific knowledge, which make up the hierarchy of ATM structures. These knowledge structures are joined with the working self, which enables an individual to draw on their memory to achieve goals. Within psychosis, Mehl et al.¹⁴ demonstrated that ATM specificity predicted social performance, involving role-play tasks, over neurocognition and symptoms. This current study aimed to understand the role of specific SDMs in predicting functional outcome, associated with mental health recovery.

Secondly, in terms of integration, individuals with psychosis extract less meaning or learn fewer lessons from the self-defining events they report, compared to healthy controls^{4,8,15,16}. Greater integration is associated with greater optimism and attainment of goals within healthy controls^{1,3}, and may be associated with neurocognition¹³.

Finally, SDM for individuals with psychosis tend to be more negative in content¹⁷, and focused on illness^{7,15,18}. This may be linked to lower self-esteem and negative outlook^{3,7}. However,

unlike specificity and integration, content valence has not previously been associated with neurocognition nor outcomes. Whilst Raffard⁷ demonstrated that memories reported by individuals with psychosis tend to be focused on hospitalization/illness, this study was conducted in an in-patient unit which may influence the type of memory recalled, due to contextual cues¹⁹⁻²⁰. This hospital-related contextual cue, coupled with known memory difficulties in schizophrenia²¹⁻²³, may have biased the individual to report a memory focused on hospitalization/illness. Another study demonstrated illness-related SDMs in a group of outpatients, however, this group included long-term schizophrenia patients⁸, who may have integrated their illness within their self, compared to an early psychosis sample. This current study aimed to investigate the pattern of SDMs in FEP and healthy controls.

Whilst studies have demonstrated differences in SDMs between individuals with psychosis and healthy controls, and studies in healthy controls show these memories may predict goal outcomes, no study has assessed the impact of SDMs on outcome in psychosis. Functional outcome is a measurable aspect of an individual's activities of daily living. This has been measured using the Time-Use Survey^{24,25}, which captures the number of hours in structured activity per week. Time spent in structured activity is on average 63.5 hours in a healthy population, 25.2 hours in a FEP sample, and 19.7 hours in a delayed recovery group²⁶. There is clear interest in the identification of those at-risk of poor functioning, to target interventions to reduce this disability.

This study will combine three theoretical frameworks of: i) cognitive and neurocognitive underpinnings of functional outcome in psychosis, ii) metacognition as a mediator of functional outcome, and iii) sense of self in psychosis. These theories will be explored in turn, to develop the rationale for the hypothesis that self-defining memories and metacognition may impact on functional outcome.

Firstly, models of functional outcome in psychosis suggest neurocognition, functional capacity and negative symptoms influence functional outcome²⁷⁻²⁹. However, the picture is complex as cognitions and negative symptoms are shown to have a synergistic interaction which impacts functioning³⁰ and the path between neurocognition and functioning has been shown to be mediated by functional capacity and cognitive processes^{29,30,32}. Secondly, these cognitive processes include defeatist performance beliefs and self-stigma³³, and, recently also metacognition³⁴, termed 'thinking about thinking'³⁵, or the way one thinks about one's experience³⁶. Metacognition partly mediates the link between neurocognition and functional

capacity, and fully mediates between functional capacity and functional outcome³² independently from symptoms³⁷⁻³⁹.

Finally, SDMs are most relevant to narrative identity² and metacognitive ability has been associated with forming complex ideas of one's life as a narrative across a lifetime^{10, 40, 41}. It may be that SDMs overlap with metacognitive ability, but involve a distinct reflective process, focusing on one memory, which, when compromised, may impact on functioning. To support this, SDMs, like metacognition, are proposed to use cognitive information to help goal outcomes¹. Negative content and poor integration might impact on optimism towards reaching a goal and poor specificity might limit the detail available regarding actions or pathways to reach goals. Reflection on the self is shown to impact goal performance⁴², which in turn impact on motivation⁴³, hope⁴⁴ and functional outcome. Based on the Beck and Rector functional outcome model²⁷ and literature within SDMs, cognitive processes could extend to SDMs and have an independent role on functioning, alongside metacognition.

Self-defining memories may contain different levels of specificity¹³, which are integrated into the sense of self. These SDMs may be used by the individual, drawing on cognitive and affective information about the self, to engage in functional activities. Following the research above, it is hypothesized that SDM will be less specific, less integrated and more negative in FEP compared to healthy controls. SDM (specificity and integration) may be associated with neurocognition and metacognition. Finally, SDMs might contribute to difficulties in functioning in FEP. This is the first study to assess the role of SDMs in the relationship between neurocognition and functional outcome, independent of metacognition, in First Episode Psychosis.

METHODS

Procedure

Ethical approval was obtained from London-Camden and Islington NHS Research and Ethics Committee (Ref: 11/LO/1877). All participants provided informed consent.

Design

This present study involved a cross-sectional design, with measures assessing neurocognition, metacognition, SDM, and functional outcome in FEP. Additional measures can be reviewed in Davies, Fowler and Greenwood manuscript³². Data from the SDM measure was compared between participants with FEP and healthy control participants.

Participants

Seventy-one young people with FEP were recruited, via a convenience sample, from outpatient Early Intervention in Psychosis services in UK. All had been given a formal diagnosis of First Episode Psychosis by a psychiatrist. Participants with a primary diagnosis of substance misuse disorder or organic neurological impairment were excluded.

Fifty-seven healthy control participants were matched on age, gender and education to the earlier psychosis sample (see table 1 with difference statistics). Participants were recruited through advertisement within the local community. Participants with current mental health problems or history of psychosis were excluded following screening questions.

Measures

Self-defining memories

Self-defining memories questionnaire⁴⁵ asked the participant to provide three descriptions of SDM. The participant was asked to provide a memory that was at least one-year-old, remembered very clearly, important to the individual, one that helped the individual to understand themselves as a person, leading to strong feelings and familiar like a picture or a song⁴⁶. The participant had to provide a title, age at the time of the event, and a description of the event.

All scripts were coded by the first author through consultation with the classification system and scoring manual of self-defining autobiographical memories⁴⁶. This manual was previously shown to have inter-rater reliability (Cohen's K 0.54 - .98) for students⁴⁴ and clinical groups^{7,15}.

Only the first memory was coded into: specificity (non-specific or specific), integration (integrated or non-integrated), type of event, content valence (positive or negative). Details in supplementary materials. A second independent rater, blind to the scope of the study, coded responses for 12% of the total scripts (15 scripts). Reliability between the two raters was good (specificity, integration and content valence, Cohen's kappa (κ) coefficient was .84, $p < .001$, and for type of event, Cohen's kappa (κ) was .83, $p < .001$).

Neurocognition

Participants completed a battery of neurocognitive measures, including Executive function (Verbal Fluency⁴⁷ and Trail-Making Task⁴⁸), memory (Logical Memory and Letter-Number Sequencing subscales (WMS-III)⁴⁹), and IQ (Vocabulary and Matrix reasoning tasks⁵⁰). All raw scores were converted into Z scores using age-scaled population means and standard deviations.

Metacognition

The Metacognitive Assessment Interview⁵¹ requires the participant to reflect on a recent difficult interpersonal experience and asked a series of questions to assess i) monitoring, identification of feelings and thoughts, ii) differentiation, distinguishing between dreams, beliefs or assumptions, iii) integration, reflection on different mental states and rules governing them, and iv) decentralization, describing the mental state of the other which is independent of their own view. These four subscales are each scored between 0-5, depending on spontaneity, use of aids/prompts and the sophistication of the answer. The scores are averaged to provide one multidimensional construct. This measure has demonstrated good inter-rater reliability and internal consistency ($\alpha=0.90$ for total metacognition), factorial validity, and reliability ($r=0.62$ to 0.90)⁵¹.

Measures of functioning

Functional outcome: Time Use Survey (adapted from Short⁵²) provides a retrospective objective measure for hours spent engaging in structured activity per week²⁴. This measure has been used within schizophrenia⁵³ and FEP sample²⁶, has good inter-rater reliability⁵⁴ ($ICC=0.99$)²⁶, and good validity at different stages of psychosis^{26, 55}.

Functional capacity: The UCSD Performance-Based Skills Assessment⁵⁶ provides a total score for real-life performance skills based on simulated tasks. This measure demonstrates high internal consistency ($\alpha=0.88$), good validity with other scales (DAFS $r=0.86$) and good test-retest reliability ($r=0.91$)^{57, 58}.

Symptoms

The Positive and Negative Syndrome Scale⁵⁹ (clinical participants only) was included, a standardized instrument for assessing symptom severity in psychosis. This measure has good internal consistency ($r=0.69 - 0.94$), construct validity ($r=0.77$) inter-rater reliability (0.83 to 0.87)^{59,60}.

ANALYSIS PLAN

Missing data was considered as ‘Missing at random’ (MAR). For regression analyses, listwise deletion was used, as recommended⁶¹. For mediation analysis, full information maximum likelihood was used which combines available information to estimate population parameters^{62,63}.

Hypothesis testing

Chi-squared analyses assessed differences in memory reported for specificity, integration, and content valence between individuals with FEP or healthy controls.

Logistic regression analyses assessed whether neurocognitive and metacognitive ability were associated with likelihood of reporting a specific or integrated SDM. Linear regression analyses assessed whether specificity and integration of SDM predicted functional outcome, controlling for neurocognition and metacognition. Finally, a mediation model was developed to assess whether specificity and integration of SDM mediate the relationship between neurocognition and functional outcome, independent of metacognition. Due to sample size, the model was built through sequential steps: i) neurocognition to functional outcome with metacognition as a single mediator, ii) with SDM as single mediator, iii) with all significant mediators.

RESULTS

Sample characteristics

A total of seventy-one participants with First Episode Psychosis completed the assessments (mean age = 25.93, S.D. 5.55, range 18-39). Fifty-seven healthy control participants completed the SDM measure (mean age = 24.84, S.D. 6.34, range 18-39).

[INSERT TABLE 1 HERE]

Data checking

All variables were checked for skewness, kurtosis and outliers. UPSA total was positively skewed and, therefore, transformed using square root transformation.

Frequency and descriptive statistics

Sixty% of FEP and eighty-nine% of healthy controls provided three SDMs. Due to the limited number who provided all three memories, only the first SDM was coded.

Frequency statistics for SDMs are presented in table 2 and supplementary materials 2.

[INSERT TABLE 2 HERE]

Descriptive statistics for neurocognitive, metacognitive, and outcome variables are presented in table 3.

[INSERT TABLE 3 HERE]

Hypothesis testing

Hypothesis 1

A significant difference was found between groups on frequency of integrated memory reported, $\chi^2(1, N = 128) = 21.52, p < .001$. Table 2 highlighted 13 out of 71 individuals with FEP reported an integrated memory, compared to 33 out of 57 healthy control participants.

[INSERT FIG. 1 HERE]

No difference was found for frequency of specificity ($p = .11$) and content valence ($p = .15$) between the groups.

Hypothesis 2

To understand the relationship between SDMs and neurocognition, a single neurocognitive factor was created using the z-scores of all neurocognitive variables, following research which assumes a single neurocognitive factor^{34, 64-67}.

Logistic regression analysis assessed whether neurocognition could determine the likelihood of SDM to be specific or non-specific. This model was significant ($\chi^2 = 8.0, df = 1, p = .005$). Neurocognition explained 14.8% (Nagelkerke R^2) of the variance in specificity and correctly classified 69% of the cases. Neurocognition did not predict integration ($p = .28$).

Hypothesis 3

Logistic regression analysis assessed whether metacognitive ability could determine the likelihood of SDM to be specific or non-specific. The model was significant ($\chi^2 = 16.16, df = 1, p < .001$). Metacognition explained 28.7% (Nagelkerke R^2) of the variance in specificity and correctly classified 75.7% of the cases. Metacognition did not predict integration ($p > .2$).

Hypothesis 4

Specificity was a significant predictor of functional outcome, whilst controlling for metacognition (neurocognition was not significant after including metacognition). This model predicted 70.4% (adjusted $r^2 = .70$) of the variance in functional outcome score ($R^2 = .70, F(2, 68) = 78.67, p < .001$); specificity predicted 1.8% of this variance and improved the baseline model ($\Delta R^2 = .02, F(1, 66) = 4.08, p = .047$). Individuals who reported a specific self-defining

memory had a mean time-use score of 43.3 (S.D 3.92) hours within structured activity per week, compared to those with non-specific SDM, mean of 14.92 (S.D 2.44) hours.

When including depression as a covariate, for 21 participants with individualised PANSS scores, depression did not predict functioning ($p>.05$) and specificity was still a significant predictor of functioning ($\Delta R^2=.38$, $p=.003$).

Integration did not predict functional outcome. Functional capacity was not predicted by any SDM variable.

Mediation model

The mediation was conducted using Mplus with Multiple Mediation Model (structural equation modelling) using Maximum Likelihood Estimation (MLE), bootstrapping and corrected confidence intervals, following Preacher and Hayes (2008)⁶⁸ causal steps of mediation.

A series of mediation models were conducted to identify the indirect mediating effect of specificity of SDM between neurocognition and functional outcome, independent of metacognition. A full multiple mediation model is presented.

We aimed to confirm a single neurocognitive factor solution using a confirmatory factor analysis of neurocognition Z scores. However, a CFA demonstrated that a 1-factor solution for neurocognition was not a good fit to the data [$\chi^2(20) = 79.5$, $p=.00$, CFI = .75, TLI = .65, RMSEA = 0.21]. Instead, neurocognition was a 2-factor solution containing Factor 1 representing memory: Immediate and delayed logical memory and factor 2 representing ‘other’ neurocognition: Letter-Number sequence, executive functioning, verbal and performance IQ. The model demonstrated an excellent fit [$\chi^2(19) = 18.92$, $p=.46$, CFI = 1.0, TLI = 1.0, RMSEA = 0.00]. From this point forward, all analyses are conducted first with the memory neurocognitive factor then the ‘other’ neurocognitive factor.

Firstly, the mediating effect of metacognition on the relationship between memory and functional outcome was tested. Significant direct pathways were found between memory and metacognition ($\beta=.62$, $p<.001$) and metacognition and functional outcome ($\beta=.78$, $p<.001$). Metacognition significantly and fully mediated the relationship between memory and functional outcome ($\beta = .48$, $p<.001$, $\pm 95\%$ CI [0.36,0.6]).

Secondly, the mediating effect of self-defining memories was tested. A significant direct pathways were found between memory and functional outcome ($\beta=.31$, $p=.01$), memory and specificity of SDM ($\beta=.41$, $p=.013$), and specificity of SDM and functional outcome ($\beta= .61$, $p<.001$). Specificity significantly and partially mediated the relationship between memory and functional capacity ($\beta = .25$, $p=.021$, $\pm 95\%$ CI [0.04,0.46]).

Finally, a full multiple mediation model was conducted with mediating effect of metacognition and SDMs on the relationship between memory and functional outcome. A significant direct pathway was found between memory and metacognition ($\beta= .62$, $p<.001$) and specificity of SDM ($\beta = .41$, $p=.013$). A significant direct pathway was found between metacognition and functional outcome ($\beta= .58$, $p<.01$), and specificity of SDM and functional outcome ($\beta=.4$, $p<.001$). Metacognition significantly mediated the relationship between memory and functional outcome ($\beta = .36$, $p<.001$, $\pm 95\%$ CI [0.22,0.5]) and specificity of SDM also significantly mediated the relationship between memory and functional outcome ($\beta = .16$, $p=.047$, $\pm 95\%$ CI [0.02,0.32]). The direct pathway was non-significant suggesting a full mediation model.

Factor 2: ‘other’ neurocognitive factor significantly predicted functional outcome, $\beta = .47$, $p<.001$. However, this factor did not predict specificity and, therefore, not included in the model.

[INSERT FIG. 2 HERE]

DISCUSSION

This was the first study to demonstrate that individuals with FEP displayed different patterns of SDMs compared to healthy control participants. Those with FEP were less likely to report integrated SDMs, compared to controls. This supports research in chronic schizophrenia cohorts^{8,15}, but demonstrates that deficits exist at first-episode rather than as a result of chronic illness. Integration may enable the individual to interpret events as meaningful to themselves and define who they are as a person. This may be disrupted in psychosis, as outlined in the ‘disrupted self’ framework^{69,70}. Berna et al. (2011)⁸ demonstrated that individuals with schizophrenia report fewer integrated memories and more trauma-related memories. It may be suggested that trauma memories are not integrated into the self, to avoid continued distress, but consequentially leave a fractured sense of self.

Although non-significant, individuals with psychosis reported less specific memories and more negative memories which focused on i) negative relationships, ii) trauma, iii) failure, and iv) illness. This is aligned with research which suggest those with psychosis have poorer social relationships^{71,72} and more interpersonal, trauma memories⁷³⁻⁷⁶. The lack of significant difference between the groups may be because these memories may be less prominent in the early stages of psychosis.

A small proportion of participants reported SDMs related to hospitalization/illness, in contrast to Raffard et al⁷. This may have been triggered by the hospital contextual cues in Raffard's study, whilst the present study was conducted in a community setting. Alternatively, this FEP group may not have integrated the illness into their identities, compared to a chronic schizophrenia group.

Memory specificity was significantly associated with functional outcome in FEP, independent of neurocognition and metacognition. This supports functional outcome models which suggest neurocognition^{27,28,31,32} and metacognition³⁴ play an important role in functioning in psychosis, but demonstrates a role of a distinct, reflective process of reporting SDMs on functional outcome. Individuals with FEP who report a specific SDM spent 43.3 hours within structured activity per week, compared to those who reported a non-specific SDM who were engaged in 14.9 hours. In comparison, Hodgekins et al²⁶ demonstrated that individuals with FEP spent 25.2 hours in structured activity compared to 19.7 hours for a delayed recovery group. The differences reflect important clinical differences in recovery trajectories.

Integration and valence are important aspects of SDMs, and the fewer integrated memories in FEP is an important finding, but these aspects of SDMs did not predict functional outcome in FEP. This may be a power issue, due to the reduced number of integrated memories in FEP, or integration may be more related to trauma, and therefore symptoms⁷⁷. Blagov & Singer³ and Singer, Rexhaj & Baddeley⁷⁸ demonstrated a negative correlation between specificity and integration. However, Blagov & Singer³ explicitly requested important memories to one's life which may have encouraged a focus on integration, at the expense of specificity, and Singer, Rexhaj & Baddeley⁷⁸ demonstrated no such relationship in older participants, due to the greater ability of older adults to provide both integrated and specific SDMs. Following Conway and Pleydell-Pearce¹³, specificity needs to be present within event, general and lifetime memories in order to describe how the memory was integrated. An individual may need to have a certain level of specificity in SDM, in order to integrate this memory to influence functioning.

Specificity, or the ability to report a detailed SDM, may have enabled the individual to reflect on their previous experiences in a coherent manner, to identify important memories to the self and identity. This identity may allow the individual to view themselves as a person with skills and draw specific detail into their SDMs to guide function. This ability may allow them to accurately reflect on their ability and monitor errors, which facilitates engagement in activities. This furthers research within a healthy sample^{1,3}.

The mean word count for the FEP group was lower than for the healthy control group and lower than that reported by Raffard et al⁷. The word count was greater than that reported by Jobson and O’Kearney⁷⁹ and similar to Singer and Moffitt⁴⁵. This FEP sample may have written fewer words due to the lack of specific memories, supported by a previous positive association between word count and specificity⁷, although it was possible to have memories that were brief (15 words) and specific. Alternatively, the lower word count may have been due to data collection (asking participants to write the memory down) or lack of motivation, previously been linked to functioning^{80, 81}. Future studies should explore these hypotheses.

The impact of specificity on functioning was independent of metacognition, thus highlighting a novel contribution of SDMs. Metacognition significantly predicted the likelihood of reporting a specific memory, which suggests metacognition is associated with difficulties in recalling autobiographical memories and organizing one’s experience into a coherent narrative⁴⁰.

Neurocognition also significantly predicted the likelihood of reporting a specific SDM, supporting previous research^{9,10,82}, however, both metacognition and SDMs have an independent role in predicting functioning. Theoretically, it is expected that SDMs are particularly pertinent to functioning in psychosis. They are associated with goal outcomes¹, and the typical age of reported SDM is 20-24 years in controls, compared to 15-19 years in a schizophrenia sample⁷, which is before the onset of psychosis⁸³, highlighting the interest in understanding the connection between psychosis, SDMs and functioning. However, this might apply to autobiographical memories more broadly, not just self-defining memories. Future studies could include a control condition which asks participants to provide an autobiographical memory which is not self-defining.

In terms of clinical implications, Lysaker and Klion (2017)⁸⁴ recently outlined the Metacognition Reflection and Insight Therapy (MERIT), which is specifically aimed at

improving metacognition^{85,86}. In addition, narrative enhancement and cognitive therapy aims to construct positive narratives about the self⁸⁷. Given the partial mediation effect of SDMs between neurocognition and functioning, therapies should focus on improving both metacognitive and neurocognition, e.g. Cognitive Remediation, shown to improve both neurocognition and real-life skills⁸⁸.

Limitations

Firstly, the sample was small, particularly for analysis of binary variables, as larger samples are needed for complex mediation models⁸⁹. Hence the use of single mediation models. Future studies should aim to replicate this finding in a sufficiently powered multiple mediation model. Secondly, in a sub-sample, the results remained after controlling for depression. However, as depression was previously shown to influence functional outcome in schizophrenia^{90,91} and specificity of autobiographical memories⁹², a follow-up study should consider this further in order to replicate this finding.

Thirdly, the self-defining memories questionnaire does not explicitly state that the memory description should explain why this memory is meaningful; characteristic of an integrated memory. This lack of instruction may have influenced integration in their reporting. Future studies should include a spontaneous and cued integration response; akin to Berna et al⁸. Using the Metacognitive Assessment Scale-Abbreviated⁹³, assessing one's acknowledgement of distress and management of difficulties, correlated with social functioning⁹⁴, may provide different outcomes to MAI. Future studies could conduct a sensitivity analysis to replicate and build on these findings using the MAS-A. Due to power, this study was unable to fully separate the variance explained by neurocognition, metacognition and SDMs. Future studies should explore whether SDM is a distinct factor, or a proxy for neurocognition.

Conclusion

This study was the first study to describe SDMs in FEP, and assess the impact on functional outcome. Specificity of SDMs predicted functioning in FEP, independent of metacognition. Individuals who reported a specific SDM were more likely to utilize their real-life functional skills to partake in structured activities. In terms of clinical importance, elaborating on specific SDMs within therapeutic contexts may be useful, and future intervention strategies should explore SDMs as a tool to improve functioning.

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CONFLICTS OF INTERESTS STATEMENT

There is no conflict of interest.

Figure legends

Fig. 1: Bar graph for percentage of reported integrated self-defining memories in FEP and healthy control sample.

Fig. 2: Mediation of the effect of neurocognition to functional outcome through two covarying mediators: specificity of self-defining memories and metacognition. *** $p < .001$, ** $p < .01$, * $p < .05$.

Tables

Table 1: Sample characteristics summary table

	FEP	Healthy control	Differences test
Age, yrs. (SD)	25.93 (5.55)	24.84 (6.34)	$F(1, 125) = 36.78, p=.31$
Gender (M/F)	44/27	41/16	$\chi^2 (1, 128) = 1.41, p = .24$
Symptoms (positive)	11.77 (3.46) Range 7-19		
Symptoms (negative)	13.21 (4.85) Range 7-36		
Symptoms (general)	27.94 (6.49) Range 16-43		
Education (years)	12.8 (1.7) Range 11 – 17 years	13.37 (1.58) ¹ Range 11-17 years	$F(1, 127) = 2.86, p=.09$

Data for healthy controls was captured as categories (e.g. GCSE, A-level, Degree, higher degree) which was subsequently converted into years of education to match the FEP group.

Table 2: The frequency statistics for self-defining memories

	FEP sample		Healthy control sample		Difference tests
Specific vs. non-specific ²	66%	34%	79%	21%	χ^2 (1, N = 128) = 2.54, p =.11
Integrated vs. non-integrated³	18%	82%	58%	42%	χ^2 (1, N = 128) = 21.52, p <.001
Positive vs. Negative content	52%	48%	65%	35%	χ^2 (1, N = 128) = 2.12, p =.15
Words per first memory, Mean	58.97 (S.D=47.5, median=39, range 4-202 words)		119.04 (S.D=92.5, median=98, range 21-491 words)		t(79.38)= -4.45, p<.001
Type of event:					
<i>Recreation/Exploration</i>	22% (87% positive)		33% (46% positive)		
<i>Relationship</i>	22% (6% positive)		28% (24% positive)		
<i>Achievement/Mastery</i>	24% (100% positive)		16% (24% positive)		
<i>Guilt/shame</i>	0%		5% (100% negative)		
<i>Drug, alcohol or tobacco use</i>	0%		2% (100% positive)		
<i>Hospitalization/Stigmatization of illness</i>	6% (100% negative)		0%		
<i>Failure</i>	6% (100% negative)		2% (100% negative)		
<i>Life threatening event</i>	20% (7% positive)		12% (100% negative)		
<i>Event not classifiable</i>	0%		2% (100% positive)		

² 33% of SDMs were coded as specific positive in FEP group, compared to 47% in control group.

³ 9% of SDMs were coded as integrated positive in FEP group, compared to 40% in control group.

Table 3: Descriptive statistics for neurocognition, metacognition and functioning.

Cognitive/functioning measure	Raw scores		Z scores (created from age-scaled scores)	
	Mean (S.D)	Range	Mean (S.D)	Range
Immediate verbal memory (0-75)	28.76 (10.93)	10-55	-1.25 (1.13)	-3.16-1.3
Delayed verbal memory (0-50)	16.76 (8.34)	0-35	-1.21 (1.13)	-3.33-1.11
Letter-number sequence (0-21)	8.83 (2.47)	4-15	-.99 (.96)	-2.78-1.18
Verbal fluency (semantic)	18.85 (4.59)	9-29	-.34 (.87)	-2.18-1.42
Verbal fluency (phonemic)	33.09 (9.4)	15-55	-.87 (.97)	-2.85-1.5
Vocabulary (0-80)	53.63 (10.82)	31-73	-.28 (1.16)	-2.6-1.8
Matrix reasoning (0-35)	26.03 (4.16)	13-34	.2 (8.5)	-2.5-2
Trail-Making Test (B-A)	46.93 (31.24)	6.64-135.60	.97 (2.45)	-3.88-8.17
MAI total (0-5)	2.85 (1.2)	.44 – 4.88		
UPSA total (0-100)	72.98 (14.5)	36.62 – 95.24		
Time Use SU (hours in activity per week)	33.97 (26.57)	2.30 – 96.74		

SUPPLEMENTARY MATERIALS

Supplementary material 1

Details of coding self-defining memory: The first self-defining memory was additionally coded using the variables below:

- Age during event
- Specificity: A binary variable coding non-specific (0) or specific (1)
- Integration: A binary variable coding not integrated (0) or integrated (1)
- Content type: We used the Manual for Coding Events in Self-Defining Memories⁹⁵. This has been used in previous studies within schizophrenia research (Raffard et al., 2009) which scores the SDM into one of seven categories, but also including two additional categories: “hospitalization/stigmatization of illness” and “failure” relevant to people with psychosis. The categories included:
 - 1) Recreation/Exploration (including spiritual moments);
 - 2) Relationships (involving interpersonal investment, conflict or non-conflict);
 - 3) Achievement/mastery (effort towards goals or skills);
 - 4) Guilt/Shame (over doing something wrong);
 - 5) Drug, alcohol, and tobacco use (for recreation or self-harm);
 - 6) life-threatening/ death (perceived as such to self or others at the time of the event);
 - 7) Hospitalization/Stigma (specifically mental health illness experience and stigma);
 - 8) Failure (and negative self-perception including in a social construct);
 - 9) Event unclassifiable (rare, not fitting any of the above categories)
- Content valence: A binary variable as negative (0) or positive (1)

Content valence was added as a measure specifically to identify the impact of a positive or negative content on an individual’s real-world functioning. Positive or negative valence was decided using a similar decision making process as for content type within the Manual for Coding Events in Self-Defining Memories⁷⁶.

Supplementary material 2

Clustered bar graph demonstrating percentage of type of events reported which are divided into positive or negative content of self-defining memories for First Episode Psychosis and healthy control sample.

